DRUM TURNING MECHANISM FOR CONTINUOUS MINERS AND LONGWALL SHEARERS

BACKGROUND OF THE INVENTION

This invention relates to machines having cutting drums with bits mounted thereon, and, more specifically, to mechanisms for turning the cutting drums to permit bit removal.

Dull, broken, or missing bits can have a serious impact on the cutting performance of a mining machine. Such bits can also cause rough cutting, and rough cutting can place unnecessary stresses on the machine. Both of these factors can lead to customer dissatisfaction with the machine.

Due to the difficulty in changing bits, operators frequently put off the chore well beyond the time the bits should optimally be changed. A significant part of this difficulty is because of the difficulty in rotating the drums to provide access to the bits. There are also safety concerns. It is illegal in the USA for the main power to be applied to the machine when anyone is in the vicinity of the drums.

The current methods of turning a drum to replace the bits include:

1. Jogging the drum forward with the cutter motors. This is illegal as above unless all persons exit the vicinity of the drums, the drums are turned, and then the persons return to change the bits after the main power is removed. It is also difficult to control the amount of rotation.

2. Putting the boom down so the drums are on the floor, then moving the whole machine forward or backward to turn the drums. This has the same concerns as (1), and if the cutter

motors are accidentally energized, this can cause the machine to lurch suddenly.

3. Turning the drums manually by several persons pulling on the bit holders. This is usually done by putting the feet on bit holders near the bottom of the drum, and grabbing the bits near the top of the drum with the hands. With several people hanging on the drums in this manner, enough weight is applied to slowly turn the drums. Since the bit holders are usually wet and covered with residue, there is a potential for one or more of these people to fall in the area of the sharp bits.

4. Turning the drums with a bar. The bar is placed through a bit hole and one or more persons pull on the bar. The same concerns as (3) apply, plus there is a danger of leaving the bar in place when cutting resumes.

5. Pulling on the bits with a boat winch mounted on top of the machine. This was done in a laboratory environment but is unpractical underground due to the time to mount the winch and connect straps or cables each time the bits need to be changed and then stowing the winch afterward.

The cutter motors used on continuous miners have a cutter drum drive that includes, for each end of the drum, a motor including a hollow motor shaft and a torque shaft located within the motor shaft. The motor shaft engages the torque shaft, and the torque shaft drives the drum through a gear case. As a result, if something were to prevent the drum from turning, the torque shaft can be replace, thus saving the more difficult to repair motor shaft. More specifically, the motor shaft engages the torque shaft via a splined connection at the end opposite the gear case.

SUMMARY OF THE INVENTION

One of the principal objects of the invention is to provide a simple mechanism that permits turning of the cutting drum in a slow, easy manner so that cutting bits can be replaced.

Another of the principal objects of the invention is to utilize as much as possible the existing cutting drum structure to provide such a turning mechanism.

Another of the principal features of the invention is to utilize the above torque shaft to create such a turning mechanism.

This invention provides a drum turning mechanism that fits on the rear of the cutter motor and that provides a small amount of torque to the motor shaft when desired for drum turning at slow speed. It can be either a manual turning mechanism or one utilizing a power source separate from the main machine power. Such power can be energy stored in a battery or hydraulic accumulator.

More particularly, this invention provides a mining machine including a cutting drum, a plurality of bits mounted on the cutting drum, a base, and a boom extending between the base and the cutting drum for mounting the drum on the base. The mining machine further includes a primary cutting drum turning mechanism attached to the boom and in driving connection with the cutting drum for causing cutting movement of the cutting drum at a cutting drum cutting speed, and a secondary cutting drum turning mechanism attached to the boom and in driving connection with the cutting drum for causing turning movement of the cutting drum at a speed much less than the cutting drum cutting speed.

Currently, the end of the torque shaft opposite the gear case is accessible with minor modifications to the clutch

housing on the rear of the motor. An adapter fits this hole and allows torque to be applied to the torque shaft. As the gear case provides a considerable speed reduction and torque multiplication (typically 30:1), very little torque would need to be applied to the adapter to slowly turn the drums. This torque can be manually applied by a crank, pull rope mechanism, or ratchet. The auxiliary turning mechanism needs to be disengaged from the torque shaft during normal cutting. This could be accomplished with an overrunning clutch, or sliding gears like an automotive starter. When drum turning is required, the auxiliary motor is energized by closing a conveniently located switch or by opening a valve. The switch or valve can also be activated remotely by providing this functionality on the machine's radio remote control.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side view of part of a cutting mechanism including a boom, a cutting drum, and a cutting drum drive and an auxiliary drive of this invention.

Figure 2 is a side view, partially broken away, of the auxiliary drive of this invention.

Before one embodiment of the invention is explained in detail, it is to be understood that the invention is not limited in its application to the details of the construction and the arrangements of components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. Use of "including" and "comprising" and variations thereof as used herein is meant to encompass the items listed thereafter and

equivalents thereof as well as additional items. Use of "consisting of" and variations thereof as used herein is meant to encompass only the items listed thereafter and equivalents thereof. Further, it is to be understood that such terms as "forward", "rearward", "left", "right", "upward" and "downward", etc., are words of convenience in reference to the drawings and are not to be construed as limiting terms.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the invention is illustrated in Figures 1 and 2. More particularly, as shown in Figure 1, the invention comprises a mining machine 8 (only part of which is shown) including a cutting drum 42, bits 50 mounted on the cutting drum 42, a base 54, and a boom 58 extending between the base 54 and the cutting drum 42 for mounting the drum 42 on the base 54. The mining machine 8 also includes a primary cutting drum turning mechanism 62 attached (indirectly in the illustrated embodiment) to the boom 58 and in driving connection with the cutting drum 42 for causing cutting movement of the cutting drum 42 at a cutting drum cutting speed.

As illustrated in Figure 2, the primary cutting drum turning mechanism 62 includes a gear case 66 attached to the boom 58, and a cutter motor 70. The cutter motor 70 is attached at one end to the gear case 66 and is in driving connection with the cutting drum 42 through the gear case 66.

The motor 70 further includes a motor housing 71 attached to the boom 58, a hollow drive shaft 74 rotatably mounted within the motor housing 71, and a motor torque shaft 22 coaxial with and within the motor drive shaft 74. The torque shaft 22 extends through the hollow shaft 74 and transmits motor power to the gear case 66 in a conventional manner.

The primary cutting drum turning mechanism 62 further includes a clutch housing 26 mounted on the end of the motor 70 opposite the gear case 66. The clutch housing 26 encloses a conventional clutch assembly 75 that is attached to the torque shaft 22 and to the motor drive shaft 74, so that the motor drive shaft 74 can engage or be disengaged from the torque shaft 22.

The mining machine 8 further includes a secondary cutting drum turning mechanism 10 for causing slow gradual movement of the cutting drum 42. The secondary cutting drum turning mechanism 10 is attached (indirectly in the illustrated embodiment) to the boom 58. The secondary cutting drum turning mechanism 10 is in the form of an adapter 83 having a shaft 82 and including a torque shaft connecting means for connecting the adapter shaft 82 to the torque shaft 22. An opening 81 in the clutch housing 26 provides access to the end of the torque shaft 22. The torque shaft connecting means is in the form of the adapter shaft 82 having a threaded end that fits into a threaded hole 18 in the end of the torque shaft 22 to allow torque to be applied to the torque shaft 22.

The secondary cutting drum turning mechanism 10 further includes means for disengaging the end of the torque shaft 22 when the motor 70 is running. More particularly, in this embodiment, the disengaging means comprises an overrunning clutch 30. In other embodiments (not shown), sliding gears like on an automotive starter can be used. The secondary cutting drum turning mechanism 80 further includes means for rotating the adapter 83 at a speed significantly slower than the cutting drum cutting speed. In the preferred embodiment, a hydraulic motor 34 is used and is operable by a remotely operated switch 86 that opens a valve 46, and is powered by an accumulator 47. In other embodiments (not shown), the adapter rotating means

could be pull rope, or a crank, or a ratchet, or a small auxiliary electric motor. A hydraulic system is chosen for this embodiment because it avoids the need for an explosion-proof housing that an electric motor would need, and has sufficient torque without additional gearing. The overrunning clutch 30 is attached to the hydraulic motor 34, which is mounted to the clutch housing 38, as shown.

During normal machine operations, the accumulator 47 is pressurized by the machine hydraulic system. When the machine's main power is disconnected, the pressurized fluid in the accumulator provides energy to run the hydraulic motor 34. When it is desired to slowly turn the drums 42 for bit maintenance, the operator will open the valve 46 allowing oil to flow under pressure to the hydraulic motor 34. The accumulator's size will be chosen to provide sufficient oil for several complete rotations of the drums. The oil flow will be constricted to provide slow drum rotation. Although there are two main cutting motors on the continuous miner, it would only be necessary to add the turning mechanism to one of them.

A similar mechanism can also be applied to a longwall shearer (not shown), in order to provide for bit replacement on the shearer.

Various other features and advantages of the invention will be apparent from the following claims.